MANONMANIAM SUNDARANAR UNIVERSITY -TIRUNELVELI

PG **PROGRAMMES**

OPEN AND DISTANCE LEARNING (ODL) PROGRAMMES

(FOR THOSE WHO JOINED THE PROGRAMMES FROM THE ACADEMIC YEAR 2023-2024 ONWARDS)

M.Sc. CHEMISTRY			
Semester	**Course**	**Title of the Course**	**Course Code**
III	Core IX	Organic synthesis and Photochemistry	SCHM31
	Core X	Coordination Chemistry-I	SCHM32
	Core XI	Inorganic Chemistry Practical-II	SCHP31
	Core XII	Analytical Chemistry Practical	SCHP32
	Elective-V	Pharmacognosy and Phytochemistry	SCHE31
	Skill Enhancement Course– II	Forensic Chemistry	SCHS31
	Internship		SCHT31

Organic Synthesis and Photochemistry

Unit	Details
I	**Planning an Organic Synthesis and Control elements:** Preliminary Planning – knowns and unknowns of the synthetic system studied, analysis of the complex and interrelated carbon frameworkinto simple rational precursors, retrosynthetic analysis, alternate synthetic routes, key intermediates that would be formed, available starting materials and resulting yield of alternative methods. Linear Vs convergent synthesis based on umpolung concepts of Seeback, regiospecific control elements. Examples on retrosynthetic approach, calculation of yield, advantages of convergent synthesis, synthesis of stereochemistry-controlled products.
II	**Organic Synthetic Methodology:** Retrosynthetic analysis; Alternate synthetic routes. Synthesis of organic mono and bifunctional compounds via disconnection approach. Key intermediates, available starting materials and resulting yields of alternative methods. Convergent and divergent synthesis, Synthesis based on umpolung concepts of Seebach. Protection of hydroxyl, carboxyl, carbonyl, thiol and amino groups. Illustration of protection and deprotection in synthesis.Controlelements:Regiospecific contro lelements.Use of protective groups , activating groups, and bridging elements. Stereo specific control elements. Functional group alterations and transposition.
III	**Pericyclic Reactions:** Woodward Hoffmann rules; The Mobius and Huckel concept, FMO, PMO method and correlation diagrams. Cycloaddition and retrocycloaddition reactions; [2+2], [2+4], [4+4, Cationic, anionic, and 1,3-dipolar cycloadditions. Cheletropic reactions. ; Electrocyclization and ring opening reactions of conjugated dienes and trienes. Sigma tropic rearrangements: (1,3), (1,5), (3,3) and (5,5)-carbon migrations, degenerate rearrangements. Ionic sigma tropic rearrangements. Group transfer reactions. Regioselectivity, stereos electivity and periselectivity in pericyclic reactions.
IV	**Organic Photochemistry-I:** Photochemical excitation: Experimental techniques; electronic transitions; Jablonskii diagrams; inter system crossings; energy transfer processes; SternVolmer equation. Reactions of electronically excited ketones; $\pi \rightarrow \pi^*$ triplets; Norrishtype-I and Norrishtype-II cleavage reactions; photo reductions; Paterno – Buchi reactions;
V	**Organic Photochemistry-II:** Photochemistry of α,β- unsaturated ketones; cis-trans isomerisation. Photon energy transfer reactions, Photo cycloadditions, Photochemistry of aromatic compounds; photochemical rearrangements; photo-stationery state; di- π-methane rearrangement; Reaction of conjugated cyclohexadienone to3,4-diphenylphenols;Barton'sreactions.

Text Book

1. F. A.Carey and Sundberg,AdvancedOrganicChemistry,5th ed, Tata McGraw-Hill, New York, 2003.
2. J.March and M.Smith,AdvancedOrganicChemistry,5th ed., John-Wiley and sons, 2007.
3. R.E.Ireland,Organic synthesis,Prentice Hall India,Goelpublishing house, 1990.
4. Clayden,Greeves,Warren,Organic Chemistry, Oxford University Press, Second Edition, 2016.
5. M.B.Smith,OrganicSynthesis3rd edn,McGrawHillInternational Edition,2011.

Co Ordination Chemistry– I

Unit	Details
I	**Modern theories of coordination compounds**: Crystal field theory splitting of d orbitals in octahedral, tetrahedral and square planar symmetries, factors affecting 10Dq , crystal field stabilisation energy for high spin and low spin Oh and Td complexes, Applications CFSE, Jahn Teller distortions and its consequences. Ligand filed theory-.Molecular Orbital Theory and energy level diagrams: Sigma and pi bonding in octahedral, square planar and tetrahedral complexes.
II	**Spectral and Magnetic characteristics of coordination compounds**: Spectral Characteristics: Microstate and Term symbol for d ions Characteristics of d-d transitions, charge transfer spectra, selection rules for electronic spectra - Orgel diagrams for d 1 to d 9 configurations - Tanabe Sugano diagram for octahedral d6 complexes, nephelauxetic effect- Racha parameter and calculation of β and 10Dq octahedral d2 and d8 complexes Magnetic characteristics: Basic terminology – Types of magnetic behavior- Determination of magnetic susceptibility by Guoy Balance and Faraday methods -Spin-orbit coupling, effect of spin-orbit coupling on magnetic moments, quenching of orbital magnetic moments- Spin -state cross over - Magnetic properties of complexes with A , E and T terms. Magnetic properties of Lanthanides and Actinides – Comparison of magnetic properties of Oh, Td and square planar complexes of Fe (II),Co(II),Ni(II) and Cu(II).
III	**Stability of Coordination of complexes** Kinetic and thermodynamic stability - Inert and Labile complexes - Factors affecting stability of complexes, Stepwise and overall formation constants, Stability correlations - statistical factors, Irving William series, Macrocyclic and chelate effect. Determination of stability constant and composition of complex ions: Solubility method, Electrochemical method, Potentiometric method, Spectrophotometric method, Polorographic method and Continuous variation method (Job's method).
IV	**Kinetics and mechanisms of substitution reactions in coordination complexes**: Classification of inorganic reaction and reaction mechanism- Associative SN2, Dissociative SN1,interchange, S 1CB mechanistic pathways for N substitution reactions in octahedral complexes; acid and base hydrolysis of octahedral complexes; Classification of metal ions based on rate of water replacement reaction and their correlation to Crystal Field Activation Energy; Substitution reactions in square planar complexes: Eigen-Wilkins mechanism; Trans effect, theories of trans effect and applications of trans effect in synthesis of square planar compounds; Kurnakov test.
V	**Electron Transfer reactions and Photochemistry of coordination complexes**: Electron Transfer reactions in octahedral complexes: Outer sphere electron transfer reactions and Marcus-Hush theory; inner sphere electron transfer reactions - nature of the bridging ligand in inner sphere electron transfer reactions. Complementary and Non Complementary electron transfer reactions. **Photochemistry:** Photochemical excitation in the transition metal complexes: Properties of THEXI states- Photophysical processes: bimolecular deactivation and energy transfer, Photochemical processes: Photo-redox, photo-substitution and photo-isomerisation reactions of Cr (III) and Co (III) complexesPhotophysical and photochemical properties of [Ru(bpy)3] 2+. Applications of inorganic photochemistry: photochemical conversion and storage of solar energy-photochemical conversion of N2 to NH3. – TiO2 as a green photocatalyst in removing air and water pollutants.

Text Book

1. 1. J.E. Huheey, E.A Keiter, R.L Keiter and O.K Medhi, Inorganic Chemistry – Principles of structure and reactivity, 4 th Edition, Pearson Education Inc., 2006
2. G L Meissler and D A.Tarr, Inorganic Chemistry, 3rd Edition, Pearson Education Inc., 2008
3. D. Bannerjea, Co-ordination Chemistry, TATA Mcgraw Hill, 1993

4.	B. N. Figgis, Introduction to Ligand Fields, Wiley Eastern Ltd, 1976.
5.	F. A. Cotton, G. Wilkinson.; C. A. Murillo; M. Bochmann, Advanced Inorganic Chemistry, 6thed.; Wiley Inter-science: New York, 1988.
6.	Asim K Das and Mahua Das, Fundamental concepts of inorganic chemistry,1st eBook edition, Volume 4, CBS publishers and distributors PVT Ltd,2019
7.	B.R.Puri,L.R.Sharma and K.C.Kalia,Principles of inorganic chemistry,Vishal publications,33rd edition,2016.
8.	S.K.Agarwal and Keemti Lal, Advanced inorganic chemistry, Pragati Prakashan Educational publication,5th edition,2016.
9.	R.L.Carlin,Magnetochemistry,Springer erlag,Berlin,Germany,1986.
10.	10.A.Earnshaw, Introduction to Magneto-chemistry, Acdamic Press, Newyork, USA, 1968.

Inorganic Chemistry Practical-II

Unit	Details
I	Preparation and analysis of metal complexes by titrimetric analysis : 1. Preparation of tris(thiourea)copper(I)sulphate dihydrate 2. Preparation of potassium tris(oxalato)chromate(III) trihydrate 3. Preparation of tetramminecopper(II) sulphate 4. Preparation of hexa(thiourea)copper(I) chloride dihydrate 5. Preparation of potassium tris(oxalato)ferrate(III) trihydrate
II	Quantitative estimation of a mixture containing two metal ions (Volumetric and Gravimetric Estimations) 1. Estimation of mixture of Cu2+(V) and Ni2+(G)ions. 2. Estimation of mixture of Fe2+(V)and Cu2+(G)ions. 3. Estimation of mixture of Fe2+(V) and Ni2+(G)ions. 4. Estimation of Cu2+(V) and Ba2+(G) ions. 5. Estimation of Cu2+(V)and Zn2+(G) ions

Text Book

1.	Mounir A. Malati, Experimental Inorganic/Physical Chemistry - An Investigative, Integrated Approach to Practical Project Work, Woodhead Publishing Limited, Reprint, 2010.
2.	G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney, Vogel's Textbook of Quantitative Chemical Analysis, Revised 5 th edition, ELBS, 1989.
3.	Douglas A. Skoog, Donald M. West, F. James Holler and Stanley R. Crouch, Fundamentals of Analytical Chemistry, 8 th Edition, Brooks/ColeThomson Learning, USA, 2004.

ANALYTICAL CHEMISTRY PRACTICAL

Unit	Details
I	1. Potentiometric titration of HCl Vs NaOH 2. Determination of pKa of weak acid by EMF method. 3. Potentiometric titration of FAS Vs K2Cr2O7 4. Potentiometric titration of KI Vs KMnO4. 5. Potentiometric titration of a mixture of Chloride and Iodide Vs AgNO3. 6. Determination of the pH of buffer solution by EMF method using Quinhydrone and Calomel electrode. 7. Study of the inversion of cane sugar in the presence of acid byPolarimetric method.

II	1. Estimation of Fe and Ni by colorimetric method. 2. Determination of spectrophotometrically the mole ratio of the ferrithiocyanate complex and equilibrium constant for the complex formation. 3. Determination of the amount (mol/L) of ferricyanide present in the given solution using cyclic voltammetry. 4. Determination of the standard redox potential of ferri-ferrocyanide redox couple using cyclic voltammetry. 5. Estimation of the amount of nitrate present in the given solution using spectrophotometric method. 6. Analysis of water quality through COD, DO, BOD measurements. 7. Assay of Riboflavin and Iron in tablet formulations by spectrophotometry 8. Estimation of chromium in steel sample by spectrophotometry 9. Separation of (a) mixture of Azo dyes by TLC (b) mixture of metal ions by Paper chromatography. 10. Estimation of chlorophyll in leaves and phosphate in waste water by colorimetry.
III	Interpretation and identification of the given spectra of various organic compounds arrived at from the following spectral techniques. 1.UV-Visible 2.IR 3.NMR 4.ESR

Text Book	
1.	Vogel's Text book of Practical Organic Chemistry, 5th Ed, ELBS/Longman, England, 2003.
2.	G. H. Jeffery, J. Bassett, J. Mendham and R. C. Denney, Vogel's Textbook of Quantitative Chemical Analysis; 6th ed., ELBS, 1989.
3.	J. D. Woollins, Inorganic Experiments; VCH: Weinheim, 1995.
4.	B. Viswanathan and P.S.Raghavan, Practical Physical Chemistry, Viva Books, New Delhi,2009
5.	Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.

Pharmocognosy And Phytochemistry

Unit	Details
I	**Pharmacognosy and Standardization of Herbal drugs:** Introduction, definition, development classification and Source of Drugs: Biological, mineral, marine,and plant tissue cultures. Study ofpharmacognostic of a crude drug. Biosynthesis: Shikimic acid pathway and acetate pathway. Systematic analysis of Crude drugs. Standardization of Herbal drugs. WHO guidelines, Sampling of crude drug, Methods of drug evaluation. Determination of foreign matter, moisture Ash value. Phytochemical investigations-General chemical tests.
II	Extraction Techniques: General methods of extraction, types – maceration, Decoction, percolation, Immersion and soxhlet extraction. Advanced techniques- counter current, steam distillation, supercritical gases, sonication, Microwave assisted extraction. Factors affecting the choice of extraction process.
III	Drugs containing Terpenoids and volatile oils: Terpenoids: Classification, Isoprene rule, Isolation and separation techniques, General properties of Camphor, Menthol, Eucalyptol. Volatile Oils or Essential Oils: Method of Preparations, Classifications of Volatile oils, Camphor oil, Geranium oil, Citral- Structure and uses. Pentacyclic triterpenoids: amyrines; taraxasterol: Structure and pharmacological applications.
IV	Drugs containing alkaloids: Occurrence,function of alkaloids in plants, pharmaceutical applications. Isolation, Preliminary Qualitative tests and general properties. General methods of structural elucidation. Morphine, Reserpine, papaverine - chemical properties, structure and uses.

V	Plant Glycosides and Marine drugs: Glycosides: Basic ring system, classification, isolation, properties, qualitative analysis. Pharmacological activity of Senna glycosides, Cardiac glycosidesDigoxin, digitoxin, Steroidal saponins glycosides- Diosgenin, hecogenin. Plant pigments: Occurrence and general methods of structure determination, isolation and synthesis of quercetin and cyanidin chloride. Marine drugs -Selected Drug Molecules: Cardiovascular active substances, Cytotoxic compounds, antimicrobial compounds, antibiotic compounds, Anti-inflammatory agents. Marine toxins.

Text Book

1. Gurdeep R Chatwal (2016), Organic chemistry of Natural products, Volume I&II, 5th edition, Himalaya publishing House.
2. S.V.Bhat, B.A. Nagasampagi, M.Sivakumar (2014), Chemistry of Natural Products, Revised edition, Narosa Publishers.

Forensic Chemistry

Unit	Details
I	**Elementary Forensic Science** Definition of Forensic science, The role of Forensic laboratory, Biometrics in Personal Identification- Introduction, Concepts of Biometric Authentication, Role in person Identification, - Face Recognition, IRIS,Retina Geometry, Hand Geometry, Speaker Recognition, Signature Verification**.**
II	**Finger Printing And Forensic Serology** Fingerprinting - General principles of Finger Printing, Fingerprint Detection - Powder tests: – dry powder method, detection using cellophane tape,- Chemical tests: – silver nitrate test, iodine fuming, ninhydrin, superglue (cyanoacrylate)and ruthenium oxide tests.Forensic Serology – Blood types, Characterization of Blood stains, Blood stains patterns. Testing of Saliva .
III	**Forensic Analysis** Forensic Drug Analysis: How drugs work - analysis of selected drug classes –Gamma hydroxybutyric acid (GHB), Gamma butyro lactone (GBL), Marijuana, Anabolic steroids, Heroin, Cocaine, Amphetamines. Forensic analysis of Inks and paints :Questioned documents – Physical analysis, chemical analysis of inks and paper – analytical methods – Optical microscopy, fluorescent techniques, TLC, FT-IR.
IV	**Forensic Toxicology** Forensic Toxicology: Overview - Sample types – Blood and Plasma, Urine, Vitreous fluid, Hair. Types of Forensic Toxicology – Alcohol, Postmortem toxicology, Sport Toxicology. Analytical methods in Forensic Toxicology – Breath alcohol test (BrAC). An introduction to DNA, Forensic DNA typing - methods of DNA typing - RFLP and PCR methods – Procedures for DNA typing, Applications of DNA testing..
V	**Cyber crime technology and forensic Science** Use of computers in Forensic science: Forensic Databases, Image Databases, DNA Database. Forensic Archiving of X-Ray Spectra, Video Image Processing and Animation Software, Use of Networks in Forensic Science. Computer related crime: Definitions and types - Framework for Investigating Computer- Related Crime, Human Aspects of ComputerRelated Crime.

Text Book

1. Anil K. Jain, Arun A. Ross and Karthik Nandakumar, Introduction to Biometrics, Springer, 2011.
2. David E. Newton, Forensic Chemistry, Fact on File, Inc, 2007.
3. Suzanne Bell, Forensic Chemistry, Pearson International, Second Edition, 2014.
4. Edited by Stuart H. James and Jon J. Nordby, Forensic Science - An Introduction to Scientific and Investigative Techniques, CRC Press, 2003.